# Series Circuits

ELTN 130

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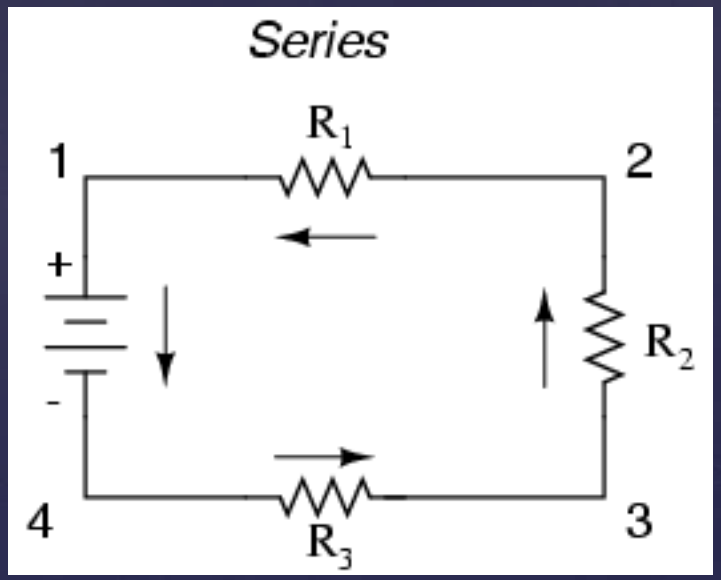
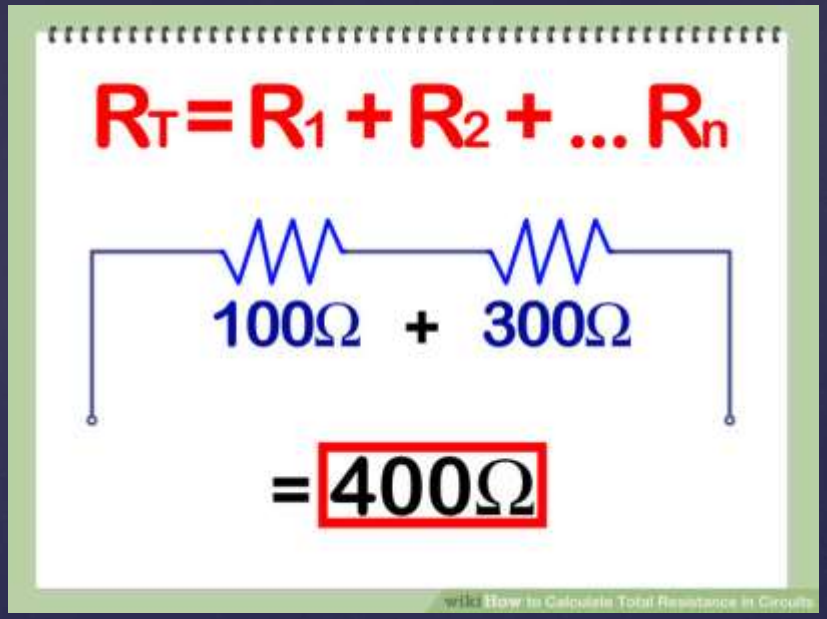
# Resistors – how they work when connected together...

Resistors can be connected together in two basic ways: *Series* and *Parallel*.



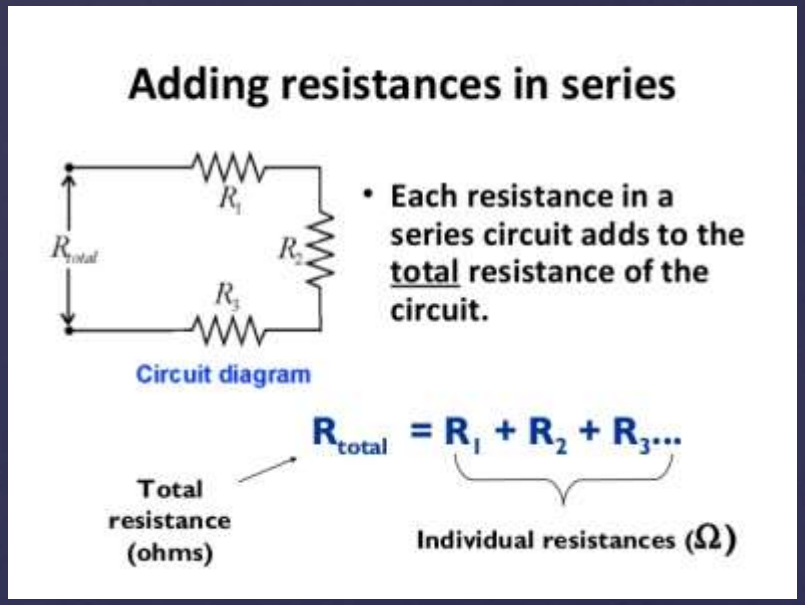

In *Series circuits* <u>each of the resistors</u> are connected <u>end to end</u>.

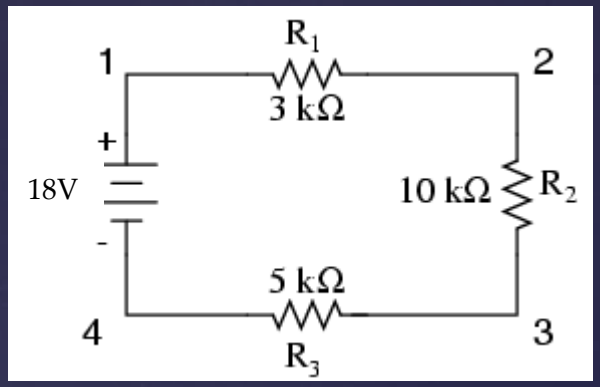
# Formulas for Series and Parallel resistors:




$R_T$ = "Total Resistance" = R1 + R2 + R3… for however many resistors there are in the circuit.

To solve series circuits with more than one resistor, we start by finding the total Resistance $R_T$ **(Total Resistance)**.



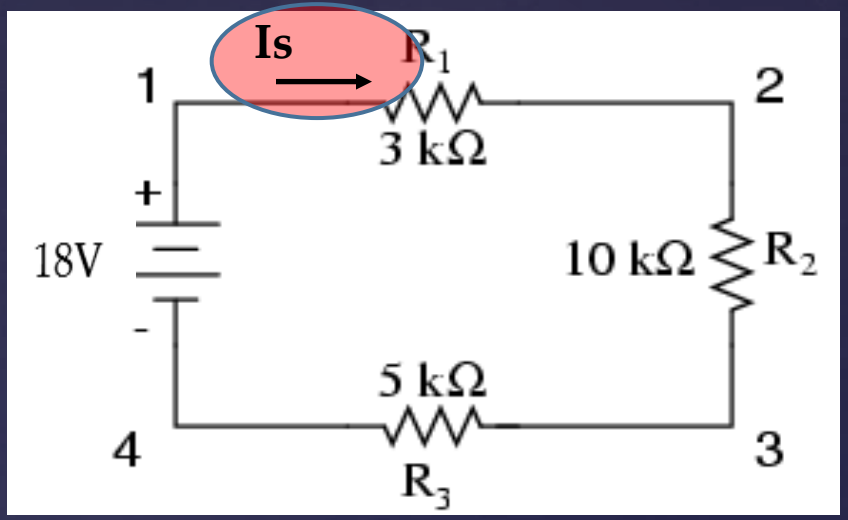




In this example, $R_T$ = **3KΩ + 10K Ω + 5K Ω = 18K Ω**

Start by adding all of the resistor values together. This equals $R_T$

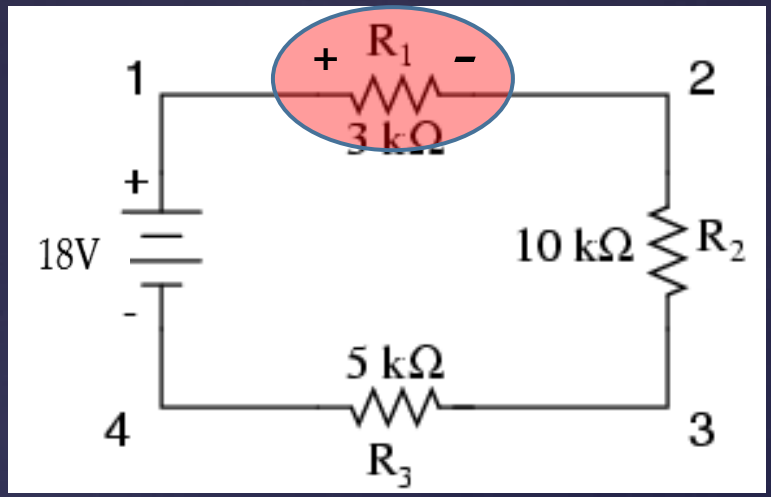
Next, we use Ohm's Law to calculate total current. This current is called Is, or the *Source current*:

1. $R_T = 18K\Omega$
2. $I_S = V/R_T$ (Ohm's Law)
3. $I_S = 18V / 18K\Omega$
4. Is = 0.001A or 1mA



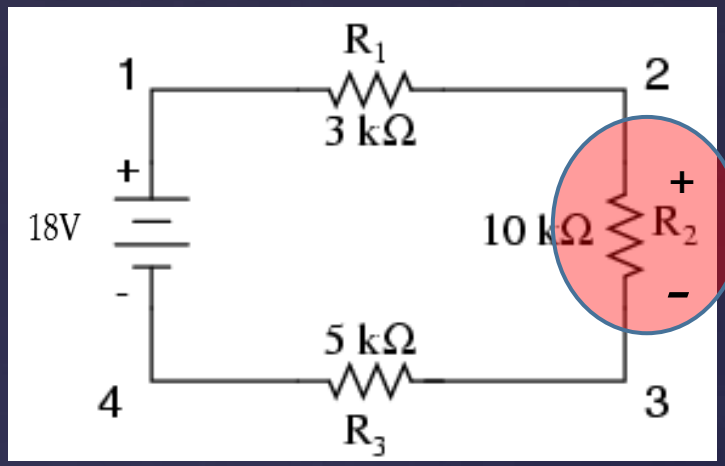
What's left? We still need to calculate the voltage across each resistor – how do we do that? Let's use Ohm's Law again…

1. $V_{R1} = I_S \times R1$
2. $V_{R1} = 0.001A \times 3000\ \Omega$
3. $V_{R1} = 3V$



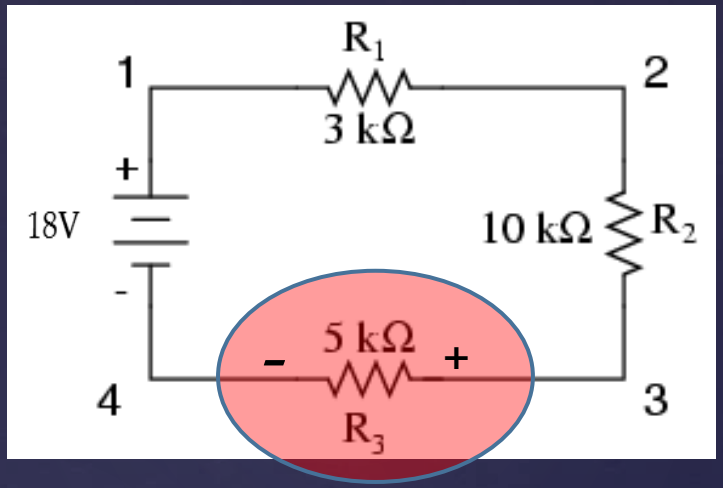
# Next we calculate $V_{R2}$:

1. $V_{R2} = I_S \times R2$
2. $V_{R1} = 0.001A \times 10K\,\Omega$
3. $V_{R1} = 10V$



# Finally we calculate $V_{R3}$:

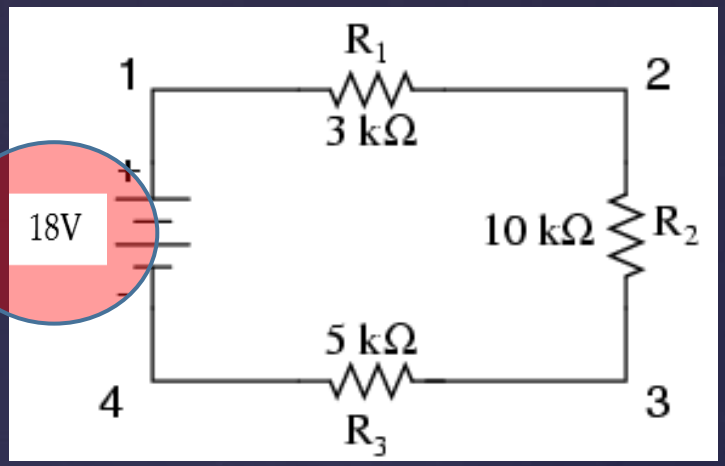
1. $V_{R3} = I_S \times R3$
2. $V_{R1} = 0.001A \times 5K\,\Omega$
3. $V_{R1} = 5V$



# Do the voltages add up?

$V_{R1} = 3V$
$V_{R2} = 10V$
$V_{R3} = 5V$

$V_T = 3V + 10V + 5V = \underline{18V}$




Since this matches the source voltage, we have validated that the input voltage equals the sum of the voltages across all of the resistors